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NATIONAL NEEDS AND ARCTIC RESEARCH:

A FRAMEWORK FOR ACTION

U. S. ARCTIC RESEARCH COMMISSION

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SUMMARY

The Arctic Research and Policy Act of 1984, which established the U.S. Arctic Research Commission, instructs it to assess national needs for Arctic research and to recommend research policy and priorities as a basis for a comprehensive five-year Arctic research plan. After public hearings and site visits in Alaska and consideration of written testimony and published reports representing the views of the concerned government and private organizations and the residents of Alaska, the Commission prepared an initial set of guidelines and general research goals and priorities as a first step toward a five-year research plan--a framework for action.

Recognizing that the problems and scientific questions, particularly for a large geographic region like the Arctic, are increasingly complex and broad in scope, typically requiring the methods, expertise and background knowledge of a variety of scientific and engineering fields for their solution, the Commission advocates an interdisciplinary, cooperative research effort. Further, it recommends that the Arctic be viewed as a large-scale natural system made up of many strongly interacting components. Understanding the processes and interrelationships within the overall Arctic system will provide the key to problems that arise in, for example, resource exploration and development, environmental protection, health, communication, and transportation in the Arctic, and often beyond it, for its influence can be worldwide, as patterns of weather and climate show.

The Commission concluded that:

- The basic premise for an Arctic Research Plan should be development of a comprehensive, interdisciplinary, coordinated approach to the acquisition of the scientific and engineering knowledge required to respond to national needs in the Arctic, including national security and defense, resource development, protection of the environment, and the well-being of the population.

The Commission emphasizes the need for both basic and applied efforts: those that will advance basic understanding of underlying processes in the Arctic system and will provide a baseline for measuring the impacts of change and development; and those that address immediate, practical problems. The research plan should combine basic and applied work, coordinated and ordered according to priorities to ensure effective use of available finances, manpower, and technological resources.

Further, the research plan must be flexible to take advantage of new knowledge and opportunities resulting from research and to respond to new problems.

The Commission recognizes the search for knowledge as a fundamental, high-priority national need and that the Arctic provides a natural laboratory for investigation of many phenomena not unique to that region, such as behavior of snow, ice and frozen ground, natural hazards, adaptations to cold, volcanism, and earthquakes. Results of Arctic research have widespread application. Therefore, the Commission views the concept of the Arctic as a natural laboratory as basic to the development of an Arctic research plan.

The Commission studied carefully the testimony and written information it received from concerned organizations and individuals on national needs, chief among which are national security, understanding of weather and climate, natural resource development, transportation, communication, environmental protection, and--a special category--needs related to health, culture, and socioeconomics of Arctic residents. The health-cultural-socioeconomic component is a basic part of the Arctic system and one in which national and regional needs coincide.

In setting research priorities, the Commission found that, in addition to national need as a criterion, the ability to predict--be it weather and climate, adverse effects of drilling noise on fish and wildlife, effects of air pollution on plants, wildlife, or human populations--is a further important criterion. If the fundamental, quantitative knowledge on which to base predictions is lacking, and the national need for such predictive capability in a particular field is great, with possibly far-reaching impact, then priorities become clear.

The priorities recommended by the Commission in this initial report are general--a framework within which to develop a program of studies and to guide allocation of funds, manpower, and facilities. The Commission believes that gaining fundamental knowledge of the interactions within the Arctic system should be the highest, general, long-range, Arctic, scientific research objective.

The atmosphere (and space), land, ocean and biota together constitute the Arctic system and dominate the interactions affecting the environment and life in the Arctic. The

Arctic Ocean and its interactions with the atmosphere merit special consideration because (a) little is known about the ocean and its seabed compared to the atmosphere and land components, and (b) the necessary marine research technology is now available, for the first time, to make detailed study of the ocean and its interactions possible.

The Commission recommends the following programs of research, listed in order of priority:

- o Research to understand the Arctic Ocean (including the Bering and marginal seas, sea ice and seabed), and how the Ocean and the Arctic atmosphere operate as coupled components of the Arctic system. Emphasis should be on advancing (a) discovery of nonrenewable resources, especially offshore oil and gas, and their development with minimal adverse impact on the environment; (b) prediction of ecosystem reactions to natural (e.g., climatic) and human-induced disturbances, including those affecting renewable resources of the Arctic continental shelves, particularly Alaska Bering Sea fisheries and the species on which the subsistence lifestyles of indigenous peoples depend; (c) forecasting Arctic weather, and its impact on worldwide weather patterns; (d) prediction of climatic change resulting from changing concentrations of carbon dioxide, other greenhouse gases, or from other causes as revealed by proxy information in marine sediments and fossils; and (e) prediction of sea ice and other conditions that affect maritime transportation and submarine operations.

- o Research to understand the coupled atmosphere and land components of the Arctic system. Emphasis should be on advancing areas of concern complementary to those of the coupled ocean and atmosphere, namely, (a) discovery and development, with minimal adverse environmental impact, of terrestrial nonrenewable resources, especially oil, gas, and hydrologic resources; (b) prediction of ecosystem reactions, particularly the effects of natural and human-induced disturbances on renewable resources; (c) understanding of atmosphere-land interactions as a basis for improved weather forecasting; and (d) understanding of the history of climatic change as revealed in ice sheets, sediments, and fossils, thereby facilitating prediction of climatic change.
- o Research to understand the the high-latitude upper atmosphere and its extension into the magnetosphere. Emphasis should be on advancing prediction of disturbances in space and mitigating their effects on high-latitude communication and defense systems.

Most of the high-priority research that the Commission recommends is relevant to the health-cultural-socioeconomic system. In addition, there is need for research on (a) health and the adaptation of Arctic inhabitants to cold, and (b) the human impact of resource development and industrial growth. The health-cultural-socioeconomic system is the highest priority from the regional viewpoint, but its problems transcend regional boundaries; they are of national as well as international significance.

Therefore, the Commission recommends that:

- The highest priority for research in the health-culture-socioeconomic system should be studies to identify and resolve the major health, behavioral, and cultural problems that derive from distinctive characteristics of the Arctic environment and from increasing resource development, industrialization, and urbanization.

Arctic research responsiveness to national needs requires adequate support services and responsible management. Because of the extremely high cost of support systems in the Arctic environment, coordination of support services and cooperation in their use are essential in achieving maximum cost-effectiveness. In this context, the Commission recommends that the following be given highest priority:

- Consolidation of an Arctic data and information transfer system and related management policy to facilitate the storage and distribution of data, ready access to up-to-date research results, and rapid flow of information about research needs, including statistics and surveys (human health, demographics, socioeconomics); glaciological, anthropological and other records of past climates, natural events, and human activity in the Arctic.
- Providing continuity in Arctic research, including mapping, baseline studies, and long-term monitoring of phenomena.

- o Furthering platform and logistic systems, in particular, assessing needs for terrestrial research sites; ice-strengthened research vessels and other ocean research platforms; remote sensing satellites and polar-orbiting platforms; in situ satellite, rocket, balloon, and aircraft measurements.
- o Cooperation in Arctic research among federal, state, and local government agencies, industry, and other elements of the private sector, as well as international cooperation, for which the Arctic is particularly well-suited.

The Arctic Research and Policy Act of 1984 provides an opportunity for Arctic research to "come of age" to meet long-neglected research responsibilities, and to promote national interests.

The Arctic Research and Policy Act of 1984 (Public Law 93-373) states that the Arctic Research Commission shall "assist in establishing a national Arctic research program plan to implement the Arctic research policy [Sec. 104 (a) (2)]." Elaborating on the plan, the Act specifies that "The Interagency (Arctic Research Policy) Committee, in consultation with the Commission, the Governor of Alaska, the residents of the Arctic, the private sector, and public interest groups, shall prepare a comprehensive 5-year plan ... for the overall Federal effort in Arctic research [Sec. 109 (a)]." The Act further specifies that the five-year plan shall contain, inter alia, "an assessment of national needs or problems ... [Sec. 109 (b) (1)]." And "proposals to meet the requirements of the policy and goals as set forth by the Commission ... [Sec. 109 (b) (4)]." In addition, the Act defines Arctic as all U.S. and foreign territory north of the Arctic Circle and all U.S. territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering, and Chukchi Seas; and the Aleutian chain.

In accordance with its mandate under the Act, the U.S. Arctic Research Commission developed a set of recommendations dealing with national needs relating to the Arctic, Arctic problems, and the research to meet them. Its recommendations include several broad research priorities. These recommendations are based on a consideration of statements on research needs and priorities

obtained through public meetings and correspondence. Representatives from the scientific and engineering community, industry, and state and local governments, as well as Arctic residents, provided information to the Commission. Its recommendations also reflect recent reports, including those issued by the National Research Council (1984;1985), the Interagency Arctic Research Policy Committee (1985), the University of Alaska School of Engineering (Haneman and Carlson, 1985), and the University of Alaska Foundation (1985).

The solution of scientific and engineering problems, whether encountered in the search for new knowledge or in the application of existing knowledge to national needs, increasingly demands interdisciplinary approaches that simultaneously draw on the methods, backgounds, and expertise of many fields. From the study of individual parts of the physical environment, of plant and animal life, and of human society, each viewed in isolation, research is beginning to focus increasingly on large systems consisting of many strongly interacting components. Processes and interrelationships within a complex but unified system have become the keys to understanding.

The Arctic is just such a large-scale natural system, consisting of closely related core components that collectively influence other parts of the earth, particularly the Northern Hemisphere. The core components comprise the land, the ocean, the atmosphere (with its extension into space) and the biota. The inter- relationships among these components are crucial, yet they are the least known aspects of the Arctic system. For example, interactions between the atmosphere and both the Arctic Ocean and the adjacent land determine Arctic weather, which, in turn, influences weather patterns and climate worldwide. Seasonal extensions of the Arctic conditions deeply affect most of the Northern Hemisphere and its industrial nations.

The Arctic has become increasingly important to world economics and world security. A significant area of the Arctic is under U.S.

sovereignty, is populated by U.S. citizens, holds a large fraction of the nation's natural resources and constitutes part of its northern defense perimeter. It also offers unique opportunities for the study of, for example, weather and climate, the exploration of a variety of engineering problems, particularly those related to resource exploration and development, and advances in health research and medicine. In addition, it is exceptionally well-suited to international cooperative research.

Therefore, the Commission concluded that:

The basic premise for an Arctic Research Plan should be development of a comprehensive, interdisciplinary, coordinated approach to the acquisition of the scientific and engineering knowledge required to respond to national needs in the Arctic, including national security and defense, resource development, protection of the environment, and the well-being of the population.

Problem solving and the research it requires can be approached from a localized, specific, highly detailed point of view or more broadly from a general, overall viewpoint. The Commission adopted the general approach in its initial work, with the objective of moving toward more specific recommendations when there is consensus among the concerned public and private organizations on the general framework and goals. However, even when adopting a broad perspective, regional needs of Arctic residents and Arctic enterprises and the way that these relate to national needs must be kept in mind.

The practical problems to be solved in the Arctic demand the achievement of a comprehensive, quantitative understanding in physical, chemical, biological and ecological terms of each one of the core components of the Arctic system: (1) The Arctic Ocean with its seafloor and adjacent seas; (2) The Arctic atmosphere and its extension into space; (3) The Arctic land mass; (4) the biota and human population in the Arctic. However, to achieve a comprehensive, quantitative understanding of the structure and inner workings of each one of the core components of the Arctic system, an interdisciplinary approach to the required research must be taken, focusing on how the components interact with each other.

Indeed, it is these interactions that are the least understood from a scientific point of view--but it is they which ultimately govern the behavior of the ocean, atmosphere, land and biota, and the changes induced in them by natural events and human activity.

Though Arctic research should be primarily interdisciplinary, research thrusts within an overall program should be well-defined, with clearly formulated objectives. Arctic research should blend basic and applied efforts, coordinated and ordered according to priorities in order to guide the allocation of funds, manpower and facilities. It is important to emphasize that acquiring basic understanding is the most practical means of ensuring a successful response to tomorrow's unanticipated national needs.

Research plans should be flexible, permitting modification of goals and schedules to meet new scientific and engineering questions as they emerge. Perhaps the most distinctive characteristic of research--both basic and applied--is the often unpredictable outcome, the new questions that are raised. Therefore, research plans and broad research programs must be reviewed periodically and be open to modification to take advantage of new knowledge and opportunities and to respond to new problems.

One aspect of knowledge is the ability to predict events, for example, weather and climate or the occurrence and effects of natural and human-induced disturbances on systems. Prediction requires a detailed, quantitative understanding of natural systems. Therefore, prediction is a touchstone that can aid the evaluation and assignment of priorities to Arctic scientific research. Problem solving is an approach which should be used for research of more immediate practical tasks.

All research is a search for knowledge, and this search for knowledge is a fundamental, high-priority, national need. We should recognize that the Arctic is a natural laboratory for much research that is not unique to the region but has much broader implications and applications; for example, research on earthquakes, volcanism, natural hazards, basic properties and behavior of snow, ice and frozen ground, and adaptations of plant, animal, and human life to extreme cold. The concept of the Arctic as a natural laboratory is basic to the development of an Arctic research plan.

National Security

National security, an obvious and fundamental need, includes not only defense but essentially all the other national needs related to the Arctic. Research is needed to provide reliable defense systems and effectively deploy defense forces. Other national security needs require research on weather, natural resources, transportation, communications and space disturbance effects, health, and all can involve geopolitical issues. All the needs contribute to the strength and well-being of the nation, and thus national security.

Weather and Climate

The influence of Arctic weather and climate extends well beyond the Arctic itself, so understanding the interactions of the atmosphere and other components of the Arctic system is essential to detailed understanding of weather throughout the

world. The Arctic is the Northern Hemisphere heat sink driving the global weather machine. Within the Arctic, among the crucial concerns are the effects of weather and climate on transportation (land, sea, and air), resource development, environmental protection, and human survival and health.

The research problems are many. A high priority is the ability to predict weather and climatic change. The effect of carbon dioxide and other so-called "greenhouse gases" whose concentrations are influenced by biological interactions and human activities could cause a major change in world climate in less than a century. Climatic variability and many of its effects are greatest at high latitudes.

Interactions between the Arctic atmosphere and the Arctic Ocean are basic to understanding and predicting climate. The scarcity of high-latitude Arctic observing stations, the consequent scarcity of environmental data, and the impact of the Arctic atmosphere and Ocean on the weather of the Northern Hemisphere, all indicate a high priority for research to improve weather forecasting and prediction of climatic change.

Natural Resources

The nonrenewable resources of Arctic Alaska while still incompletely known are a national asset with international significance. They include the oil and gas fields of the North Slope and the still undeveloped offshore petroleum resources of the Continental shelves north of the Aleutian chain and the mainland, as well as vast undeveloped coal resources and potentially

significant strategic mineral deposits. Some of Alaska's Arctic mineral resources are "world class," with the potential for lead and zinc perhaps as great as in any other region of the world.

Renewable biological resources of Arctic Alaska are mainly fishes, which are economically important for some foreign nations and vital to the Alaskan economy. Wildlife in general and marine mammals in particular have cultural significance for Alaska's residents, especially its indigenous peoples. Hydrologic systems are a critical renewable resource.

Advances in resource exploration, development, and management depend on increased knowledge. High-priority research objectives include improved ability to predict the location of nonrenewable resources, ways to improve development with minimal adverse effect on the environment, and improved understanding of the factors that affect ecosystems and the interrelationships within them that determine the distribution, maintenance, and enhancement of renewable biological resources.

Transportation

Transportation in the Arctic is a national concern because it affects the response to other needs, including resource development. The planning of land, air, and maritime transportation requires accurate knowledge of natural conditions that affect routes, such as weather and climate, seasonal or perennial ice (glaciers, river and sea ice, permafrost), snow, and other terrestrial and marine phenomena--all of which depend on interactions of the atmosphere, land, and ocean. Therefore, high-priority research includes, for the land, the changing

physical properties of permafrost and the active layer in response to seasonal changes and to on- and off-road transportation, onshore drilling, pollution, and other problems. For the ocean, high priority research includes an understanding of (a) the physical properties and behavior of sea ice as influenced by weather, and (b) seasonal changes in ice concentrations, which affect ship operations, offshore drilling, oil pollution, and marine life. The Arctic Ocean environment creates special defense-related problems with respect to submarine operation, detection, and interdiction.

Communications and Space-Disturbance Effects

The need to communicate data and information quickly, accurately and efficiently is pervasive. Modern research and satellite technology have made great advances possible, including rapid data transmission for a variety of purposes, such as satellite computer links, and remote sensing for identification and assessment of natural resources, weather and ice forecasting, mapping, and defense-related surveillance.

Arctic research itself is importantly involved because of perturbations and interruptions in telecommunications resulting from ionospheric irregularities and upper-atmosphere processes associated with the aurora and other space disturbances that occur only at high latitudes but can affect lower latitudes as well. The disturbances can affect not only radio-frequency transmission and ground- and space-based defense surveillance systems but also long conductors such as powerlines, telephone cables, and even pipelines. Understanding the high-latitude, near-earth space environment is crucial for the development of defense systems

operating outside the earth's atmosphere. Clearly, research to improve prediction of disturbances in space and to mitigate their effects is a high priority.

Environmental Protection

There is widespread agreement on the need to prevent or reduce undesirable side effects of development, especially pollution of air, water, and soil that can result not only from resource exploitation but from many kinds of industrial and other activities. Relationships within ecosystems must be studied over the long term to understand what disturbs them and how to mitigate adverse effects. Issues of environmental protection have led to much controversy among organizations and individuals representing conflicting interests and points of view. Research can help to resolve these conflicts and, for instance, protect fisheries from overexploitation, and ensure the continued subsistence use of fish, whales, seals, caribou, and various species of birds.

Health, Culture and Socioeconomics

The research discussed in relation to national needs will contribute also to both the national and the Arctic economy, and it is relevant to problems of health and culture, including impacts on the traditions and lifestyles of the indigenous peoples. The Arctic health-culture-socioeconomic component is an integral part of the Arctic system. For example, where permafrost complicates water supply and sewage disposal, public health can be widely affected. Research would include not only engineering but

scientific investigations of bacterial aids to decomposition. Other key concerns in medical and health research are adaptation to cold and transmission of diseases between wildlife and the human population (zoonotic diseases), especially among Arctic residents engaged in subsistence hunting.

Development and industrialization have diverse effects on indigenous peoples. The accompanying changing socioeconomic and sociocultural conditions--the changing perceptions of long-established values and ways of life--have led to a variety of behavioral and medical problems. There is both a national and regional moral responsibility to undertake research that will help indigenous peoples to preserve their cultural heritage--a problem common to all Arctic-rim nations--and to use their special knowledge and abilities in responsible positions to benefit their own and the broader Arctic community. Their cultural heritage, as anthropological evidence and linguistic clues from the few who still speak vanishing dialects have shown, is vital to clarifying the history of population migrations and the peopling of the Americas.

The occurrence of voluntary and involuntary injury, suicide, homicide and death due to alcohol are extraordinarily high in the Arctic. These same problems are now the major causes of potential years of life lost in our nation. Research opportunities in the Arctic, focusing on high-risk populations, will be effective in identifying intervention strategies having universal applications.

The national needs we have discussed are interrelated; for example, as noted previously, national security includes most of them. We have not attempted to rank national needs, though perception of their importance will influence the setting of research priorities. The need and opportunity for developing or improving predictive abilities will also influence priorities, and (as noted earlier), these abilities require fundamental scientific knowledge of the Arctic system, especially of basic interactions. To obtain this knowledge, we must conduct studies to provide baseline data and we must monitor the components of the Arctic system and their interactions over the long term. To gain fundamental knowledge of these interactions within the Arctic system should be the highest, general and long-range, Arctic, scientific research objective.

Recommendations

Although the atmosphere (and space), land, and ocean together dominate the interactions affecting the environment and life in the Arctic, the ocean and its interactions merit special consideration because (a) of their importance to national needs, (b) the fact that little is known about the Arctic Ocean and its seafloor compared to the atmosphere and land, and (c) the necessary marine research technology is now available, for the first time, for detailed study of the ocean and its interactions, and thus for improved predictive abilities.

Furthermore, because of the large expense and strong influence of the Arctic Ocean and its marginal seas on the atmosphere and the role of these coupled components play in determining the weather of the Northern Hemisphere, the ocean-atmosphere interactions are particularly important. Moreover, ocean-surface currents and sea-ice dynamics affect and are affected by winds and heat exchange with the atmosphere, which, in turn, are determined by Arctic weather. Although we believe research of the coupled ocean and atmosphere is of top priority, it is clear that certain research involving the land and atmosphere must be conducted concurrently, for all are interrelated. Top priority need only imply somewhat lower priority for, not neglect of, other important research.

Based on its review of national needs and research requirements and speacial considerations it has outlined, the Commisison therefore recommends the following programs of research, listed in order of priority, with the exception of the health-culture-socioeconomic component of the Arctic system, which must be considered separately.

- o <u>Research to understand the Arctic Ocean (including the Bering Sea and other marginal seas, sea ice, and sea-bed), and how the ocean and the Arctic atmosphere operate as coupled components of the Arctic system.</u> In accordance with national needs, emphasis should be on advancing (a) discovery of nonrenewable resources, especially offshore oil and gas, and their development with minimal adverse impact on the environment; (b) pre-

diction of ecosystem reactions to natural (e.g., climatic) and human-induced disturbances, including those affecting renewable resources of the Arctic continental shelves, particularly Alaska Bering Sea fisheries and the species on which the subsistence lifestyles of indigenous peoples depend; (c) forecasting Arctic weather, and its impact on worldwide weather patterns; (d) prediction of climatic change resulting from changing concentrations of carbon dioxide and other greenhouse gases, or from other causes as revealed by proxy information in marine sediments and fossils; and (e) prediction of sea ice and other conditions that affect maritime transportation and submarine operations.

- o Research to understand the coupled atmosphere and land components of the Arctic system. Emphasis should be on advancing areas of concern complementary to those of the coupled ocean and atmosphere, namely, (a) discovery and development, with minimal adverse environmental impact, of terrestrial nonrenewable resources, especially oil, gas, and hydrologic resources; (b) prediction of ecosystem reactions, particularly the effects of natural and human-induced disturbances on renewable resources; (c) understanding of atmosphere-land interactions as a basis for improved weather forecasting; and (d) understanding of the history of climatic change as revealed in ice sheets, sediments, and fossils, thereby facilitating prediction of climatic change.
- o Research to understand the high-latitude upper atmosphere and its extension into the magnetosphere. Emphasis

should be on advancing our ability to predict disturbances in space and mitigating their effects on high-latitude communication and defense systems.

Most of the high-priority research that the Commission recommends is relevant to the health-culture-socioeconomic system; for example, research dealing with ecosystems, renewable resources, and environmental protection. In addition, there is need for research on health and adaptation of people to the Arctic's physical and social environment including the effects on people of resource development and industrial growth, including problems of alcohol and drug abuse, the psychophysiological effects of long periods of darkness and light, and effects of other conditions associated with life in the Arctic. The health-culture-socioeconomic component of the Arctic system has the highest priority from the regional veiwpoint, but its problems transcend regional boundaries; they are of national as well as international significance.

- The highest priority research in the health-culture socioeconomic component of the Arctic system should be on studies to identify and resolve the major health, behavioral, and cultural problems that derive from distinctive characteristics of the Arctic environment and from increasing resource development, industrialization, and urbanization.

SUPPORT SERVICES AND MANAGEMENT

Arctic research responsive to national needs requires adequate support services and responsible management. In defining needs and assigning priorities, we must recognize that organizational and logistic support systems should be determined by scientific and engineering research requirements but that their cost in the Arctic can be greater than that of the actual research itself. Coordination of support services and cooperation in their use are essential in achieving maximum cost-effectiveness.

In this connection, the Commission recommends that the following matters receive high-priority attention, and it will continue to study them and offer further recommendations.

- Consolidation of an Arctic data and information transfer system and related management policy to facilitate the storage and distribution of data, ready access to up-to-date research results, and rapid flow of information about research needs, including statistics and surveys (human health, demographics, socioeconomics); glaciological, anthropological and other records of past climates, natural events, and human activity in the Arctic.
- Providing continuity in Arctic research, including mapping, baseline studies, and long-term monitoring of phenomena.
- Furthering platform and logistic systems, in particular, assessing needs for terrestrial research sites;

ice-strengthened research vessels and other ocean research platforms; remote sensing satellites and polar-orbiting platforms; in situ satellite, rocket, balloon, and aircraft measurements.

- Cooperation in Arctic research among federal, state, and local government agencies, industry, and other elements of the private sector, as well as international cooperation, for which the Arctic is particularly well-suited.

Through international cooperation in research, the collective scientific and engineering expertise of Arctic-rim nations can be focussed on problems of mutual concern. Cooperation between the United States and Canada is especially important because of their geographical proximity and common research interests.

CONCLUSIONS

The Arctic Research and Policy Act of 1984 provides an opportunity for Arctic research to "come of age" to meet long-neglected research responsibilities, and to promote national interests.

The Commission's initial response to its mandate is intentionally broad and general. It is an attempt to develop a framework for evaluating priorities in Arctic research and thereby to facilitate preparation of the five-year research plan called for in the Act. Once guidelines are agreed on and established, more detailed and sharply focused recommendations for Arctic research will be possible.

REFERENCES

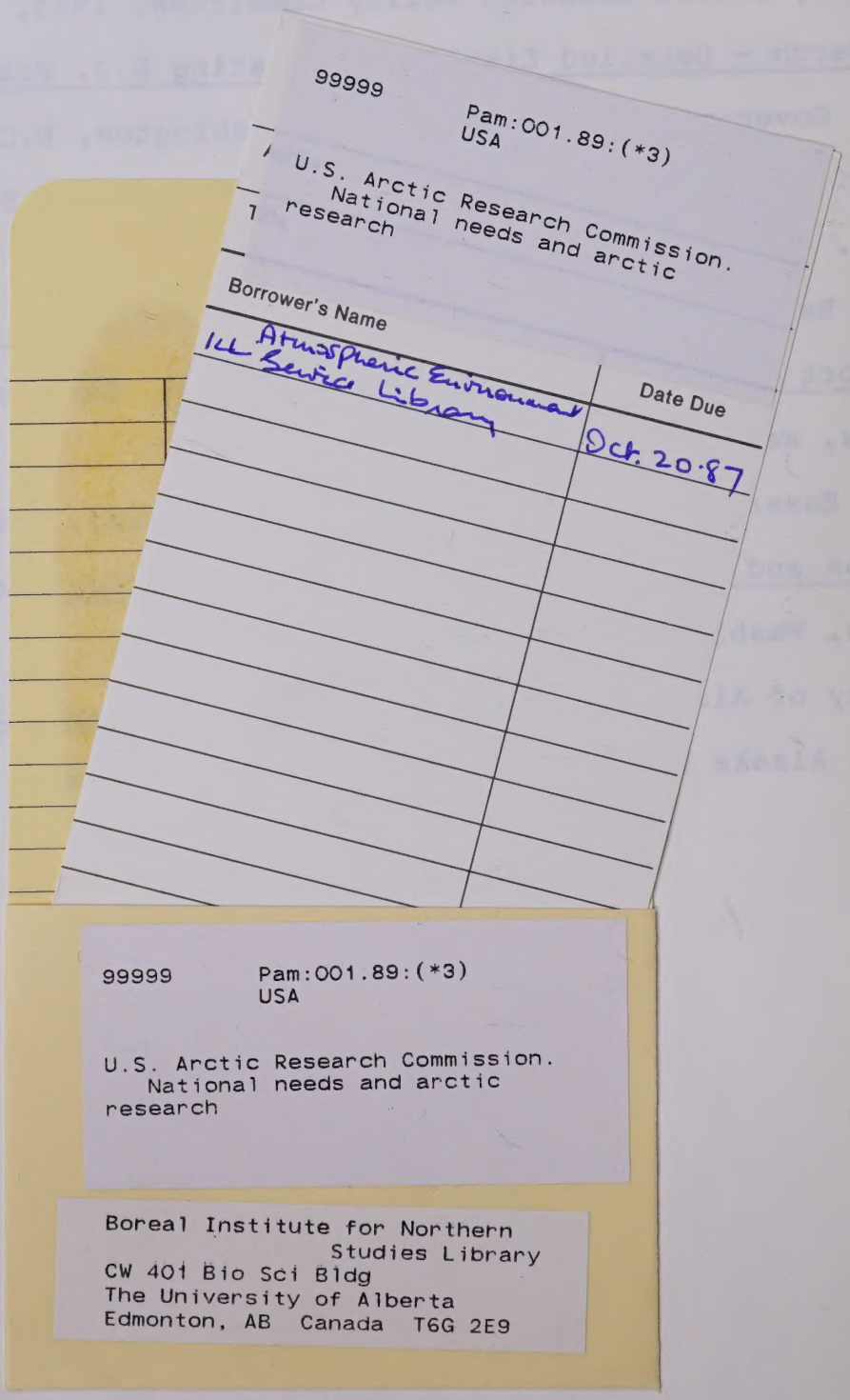
Haneman, V., and Carlson, R., Eds., Arctic Research Needs in Civil Engineering: Univ. Alaska-Fairbanks, School of Engineering, Fairbanks, Ak. (200 pp.)

Interagency Arctic Research Policy Committee, 1985, Federal Arctic Research - Detailed Listing of Existing U.S. Programs, 1985: U.S. Government Printing Office, Washington, D.C. (136 pp.) (Available from National Technical Information Service, U.S. Dept. Commerce, Springfield, Va.)

National Research Council (Marine Board), 1984, U.S. Capability to Support Ocean Engineering in the Arctic: National Academy Press, Washington, D.C. (140 pp.)

National Research Council (Polar Research Board), 1985, National Issues and Research Priorities in the Arctic: National Academy Press, Washington, D.C. (124 pp.)

University of Alaska Foundation, 1985, A Challenge to Alaska: Univ. Alaska Foundation, Fairbanks, Ak. (52 pp.)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